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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference<br>3928 PCT  | FOR FURTHER ACTION See Form PCT/IPEA/416                 |  |
| International application No.<br>PCT/SE2003/001253   | International filing date (day/month/year)<br>07.08.2003 | Priority date (day/month/year)<br>08.08.2002 |
| International Patent Classification (IPC) or national classification and IPC<br>F24B 5/26, F41B 6/00, F42B 33/00 |  |  |
| Applicant<br>Bofors Defence AB et al   |  |  |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
- a. ☒ (sent to the applicant and to the International Bureau) a total of 11 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the report
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

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| Date of submission of the demand<br><br>01.03.2004  | Date of completion of this report<br><br>27.10.2004                                 |
| Name and mailing address of the IPEA/SE<br>Patent- och registreringsverket<br>Box 5055<br>S-102 42 STOCKHOLM<br>Facsimile No. +46 8 667 72 88 | Authorized officer<br><br>Christer Wendenius / MRO<br>Telephone No. +46 8 782 25 00 |

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/001253

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 19 as originally filed/furnished
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:
- pages \_\_\_\_\_ as originally filed/furnished
- pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19
- pages\* 1 - 7 received by this Authority on 18.05.2004
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:
- pages \_\_\_\_\_ as originally filed/furnished
- pages\* 1 - 4 received by this Authority on 18.05.2004
- pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/001253

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

|                               |        |             |     |
|-------------------------------|--------|-------------|-----|
| Novelty (N)                   | Claims | <u>1-25</u> | YES |
|                               | Claims |             | NO  |
| Inventive step (IS)           | Claims | <u>1-25</u> | YES |
|                               | Claims |             | NO  |
| Industrial applicability (IA) | Claims | <u>1-25</u> | YES |
|                               | Claims |             | NO  |

## 2. Citations and explanations (Rule 70.7)

The invention concerns a cartridge case of the kind stated in the preamble of claim 1.

In order to produce a new type of insulated or insulating cartridge case and ammunition round primarily for electrothermochemical weapon systems which cartridge case and which ammunition round are insulated in such a way that they considerably reduce the problems of the application of current and voltage to the barrel and other sensitive parts of the weapon system and also the risk of the cartridge case burning on in the said barrel and chamber, the casing, including the bottom or the bottom piece, comprises or consists of one or more insulated or insulating shells, layers or surfaces at least electrically, insulating the casing of the cartridge case and its bottom or bottom piece from the rest of the ammunition round including its firing device when the round is stored and handled and, when the round is used, from the barrel of the weapon system as well.

The invention also concerns a ammunition round comprising such a cartridge case as stated in claim 12, a cartridge case and ammunition round comprising such a cartridge case as stated in claims 13 and 14, an ammunition round with such a cartridge case as stated in claims 15 and 16, and a method for producing such a cartridge case as stated in claim 17

Cited documents:

D1: EP 0736742 A1

D2: WO 0177604 A1

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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

D1 or D2 do not disclose a cartridge case of the kind stated in claim 1. A combination of D1 and D2 does not lead to the invention.

As the invention stated in claims 1-25 are new, are considered to involve an inventive step, and also are industrially applicable, the patentability criteria are deemed to be met.

PATENT CLAIMS

1. Cartridge case (2) and ammunition round (1)  
primarily for electrothermal and/or  
5 electrothermochemical weapon systems, which round (1)  
comprises the said cartridge case (2) and a bottom or a  
bottom piece (16), characterized in that the casing  
(10) including the bottom or the bottom piece (16)  
comprises or consists of one or more insulated or  
10 insulating shells, layers or surfaces (11, 12, 13) for,  
at least electrically, insulating both the casing (10)  
of the cartridge case (2) and its bottom or bottom  
piece (16) from the rest of the ammunition round (1)  
including its firing device (5) when the round (1) is  
15 stored and handled and, when the round (1) is used,  
from the barrel (14) of the weapon system as well.

2. Cartridge case (2) and ammunition round (1)  
according to Claim 1, characterized in that the casing  
20 (10) of the cartridge case (2) comprises a load-bearing  
case shell (11), for example in the form of a  
conventional cartridge case (2) manufactured from an  
electrically conductive metal, for example brass, of  
which at least the shell (11) or one inner and an outer  
25 coating, surface or layer (12, 13) is dielectric for  
the electric insulation of the case (2) in relation to  
the barrel (14) and to the rest of the ammunition round  
(1) including the firing device (5) of the ammunition  
round (1).

30  
3. Cartridge case (2) and ammunition round (1)  
according to one of the preceding claims, characterized  
in that the cartridge case (2) has a casing (10) which  
comprises at least one inner and/or outer coating,  
35 surface or layer (12, 13) which is a mechanically  
applied layer or a chemically or electrochemically  
applied surface.

4. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that at least one inner and/or outer coating, surface or layer (12, 13) consists of a material applied by phase transformation, such as vaporization and condensation to form an insulating film (12, 13), preferably a dimeric or polymeric raw material comprising hydrocarbons, such as poly-paraxylylene or another suitable plastic.

5. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that at least one inner and/or outer shell or layer (11, 12, 13) consists of shape-imitating shrink film or flexible tube (11, 12, 13) made of preferably non-conductive material, such as rubber or plastic.

6. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that the casing (10) of the cartridge case (2) comprises or consists of a non-conductive or electrically insulating load-bearing material, shell, layer or surfaces (11, 12, 13), such as hard plastic, ceramic, rigid rubber, fibre composite etc.

7. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that the casing (10) of the cartridge case (2) comprises or consists of a relatively flexible non-conductive or electrically insulating shell or layer (11, 12, 13) which is constructed from a glass-fibre laminate.

8. Cartridge case (2) and ammunition round (1) according to Claim 7, characterized in that the casing (10) of the cartridge case (2) has a glass-fibre thread winding which is arranged along the case jacket (15) at

a winding angle  $\alpha$  defined for each ply to the longitudinal axis Y of the case (2).

9. Cartridge case (2) and ammunition round (1)  
5 according to any one of the preceding claims, characterized in that the firing device (5) is arranged detachably on a bottom (16) integrated with the casing (10) of the cartridge case (2).

10 10. Cartridge case (2) and ammunition round (1) according to any one of the claims 1 to 8, characterized in that the firing device (5) is arranged detachably on a separate bottom piece (16) arranged demountably with the casing (10) of the cartridge case  
15 (2).

11. Ammunition round (1) with cartridge case (2) according to Claim 5, characterized in that the round (1) comprises a propellant charge (7) and that the  
20 shrink film or the tube (11, 12, 13) is arranged on the outside of the said propellant charge (7).

12. Ammunition round (1) with cartridge case (2) according to Claim 11, characterized in that the  
25 propellant charge (7) consists of a cartridge-shaped charge which is surrounded by the shrink film or the flexible tube (11, 12, 13) for forming a cartridge-shaped, and if appropriate vacuum-packed, round (1) which stands up to normal handling of the round (1).

30 13. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that the bottom piece (16) is made of glass-fibre epoxy, and arranged on the casing (10) in a  
35 tight-fitting manner by means of screw-thread cutting, adhesive bonding or by means of another connection suitable for the function.

14. Cartridge case (2) and ammunition round (1) according to any one of the preceding claims, characterized in that the rear end (30) of the firing device (5) comprises an electric connection (19), by means of which the ammunition round (1), once introduced into the chamber (17) of the weapon concerned, is in electric contact with the high-voltage source (18) of the weapon concerned via the firing device (5).

15. Ammunition round (1) with cartridge case (2) according to any one of the preceding claims, characterized in that the firing device (5) comprises a plasma torch (5).

16. Ammunition round (1) with cartridge case (2) according to any one of Claims 1-13, characterized in that the firing device (5) of the ammunition round (1) consists of a fuse for use of the cartridge case (2) and the ammunition round (1) in other more conventional weapon systems than the said electrothermal and/or electrothermochemical weapon systems.

17. Method for manufacturing a cartridge case (2) and an ammunition round (1) primarily for electrothermal and/or electrothermochemical weapon systems, which round (1) comprises a cartridge case (2) according to any one of Claims 1-16, characterized in that at least one of the shells or layers (11, 12, 13) which form part of the casing (10) of the cartridge case (2) is manufactured by glass-fibre thread being wound with resin in layers with varying winding angles  $\alpha$  sandwiched with woven glass-fibre fabric so that a plurality of winding plies/laminate layers (11, 12, 13) are obtained after hardening.

18. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to Claim 17,



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characterized in that for every such winding ply/laminate layer (11, 12, 13), a fibre winding with fibre angles of essentially roughly  $90^\circ$  to the longitudinal axis of the tube on the inside and +/- roughly 15-25°, preferably +/- 20°, on the outside is selected, and in that a number of such winding plies (11, 12, 13) are laid on top of one another and sandwiched with woven glass-fibre fabric between a number of the thread-winding plies so that an essentially flexible case jacket (15) is obtained, as a result of which the casing (10) of a round (1) introduced into the cartridge chamber tolerates being expanded towards the walls of the cartridge chamber by the inner overpressure inside the cartridge case (2) brought about when firing takes place without for that reason cracking, delaminating or disintegrating.

19. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to any one of Claims 1-17, characterized in that at least one of the shells or layers (11, 12, 13) which form part of the casing (10) of the cartridge case (2) is manufactured by a glass-fibre fabric being applied to a winding and shaping tool which is rotated while the fabric is draped over it, the last piece of the woven glass-fibre fabric being laid so that a small overlap is formed, after which a first winding ply of glass-fibre thread in resin is wound with a fibre angle to the longitudinal axis of the tube of essentially  $90^\circ$ , followed by two or more winding plies of thread with a fibre angle, which is varied for the component plies, of on the one hand roughly +15-25°, preferably +20°, and on the other hand roughly -15-25°, preferably -20°, after which the subsequent, winding plies/laminate layers (11, 12, 13) are also given a fibre winding with a fibre angle to the longitudinal axis of the tube which varies between essentially roughly  $90^\circ$  and +/- roughly 15-25°, preferably +/- 20°, as the thickness of

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the casing (10) is built up to roughly half-thickness, after which woven glass-fibre fabric is sandwiched with fibre windings with a fibre angle of essentially 90° until full shell or layer (11, 12, 13) thickness has  
5 been achieved.

20. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to any one of Claims 17, 18 or 19, characterized in that a relatively low  
10 winding speed is used, preferably roughly 4-6 m/min, while a relatively high thread tension, roughly 21-23 N/roving, and a hardening cycle which comprises a plurality of hardenings at increasing temperatures are selected.

15 21. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to Claim 20, characterized in that use is made of a hardening cycle of roughly 5 hours at roughly 80°, followed by roughly  
20 5 hours at roughly 120°, after which after-hardening takes place for roughly 4 hours at roughly 140°.

22. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to any one of the  
25 preceding claims, characterized in that after shaping of a blank for the casing (10), this is cut and/or turned/ground to essentially the desired length, thickness and predetermined shape, after which a bottom piece (16) is mounted on the rear end (6) of the casing  
30 (10) in a tight-fitting manner, preferably by adhesive bonding or screw-thread cutting.

23. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to any one of the  
35 preceding claims, characterized in that the bottom piece (16) is manufactured from glass-fibre epoxy, either by glass-fibre thread and/or woven glass-fibre fabric being given during shaping the form of a hammock

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where only tensile loads in the fibres can occur or by glass-fibre thread and/or woven glass-fibre fabric being given during shaping the form of a plane bottom so that pressure loads also can occur, after which the bottom piece (16), after shaping and hardening have been completed, is then turned out.

24. Method for manufacturing a cartridge case (2) and an ammunition round (1) primarily for electrothermal and/or electrothermochemical weapon systems, which round (1) comprises a cartridge case (2) according to any one of the preceding claims, characterized in that an insulation coating (12, 13) is applied over all the shell or layer surfaces of the cartridge case (2) concerned which are accessible to gas by phase transformation via a number of phases, a dimeric or polymeric raw material being vaporized so that the polymer or the dimer is first transformed from solid phase to gas phase and then, at a further increased temperature, is transformed to a reactive monomer gas which is made to condense and polymerize, a thin insulating plastic film layer (12, 13) being deposited on all the free surfaces of the cartridge case (2).

25. Method for manufacturing a cartridge case (2) and an ammunition round (1) according to Claim 24, characterized in that the condensation of the reactive monomer gas to form an insulating film (12, 13) takes place under low pressure, preferably in a vacuum.

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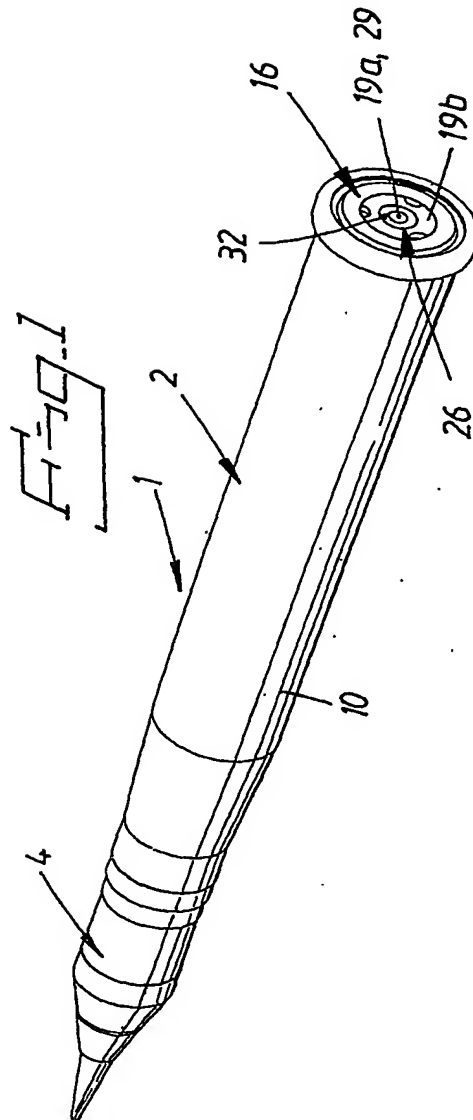
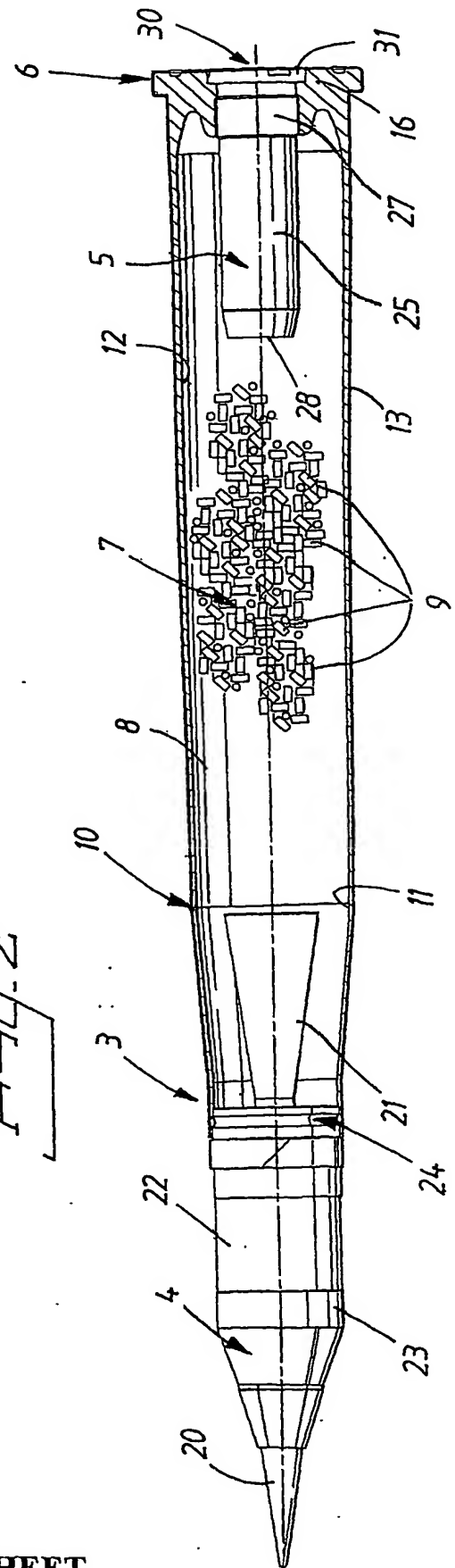
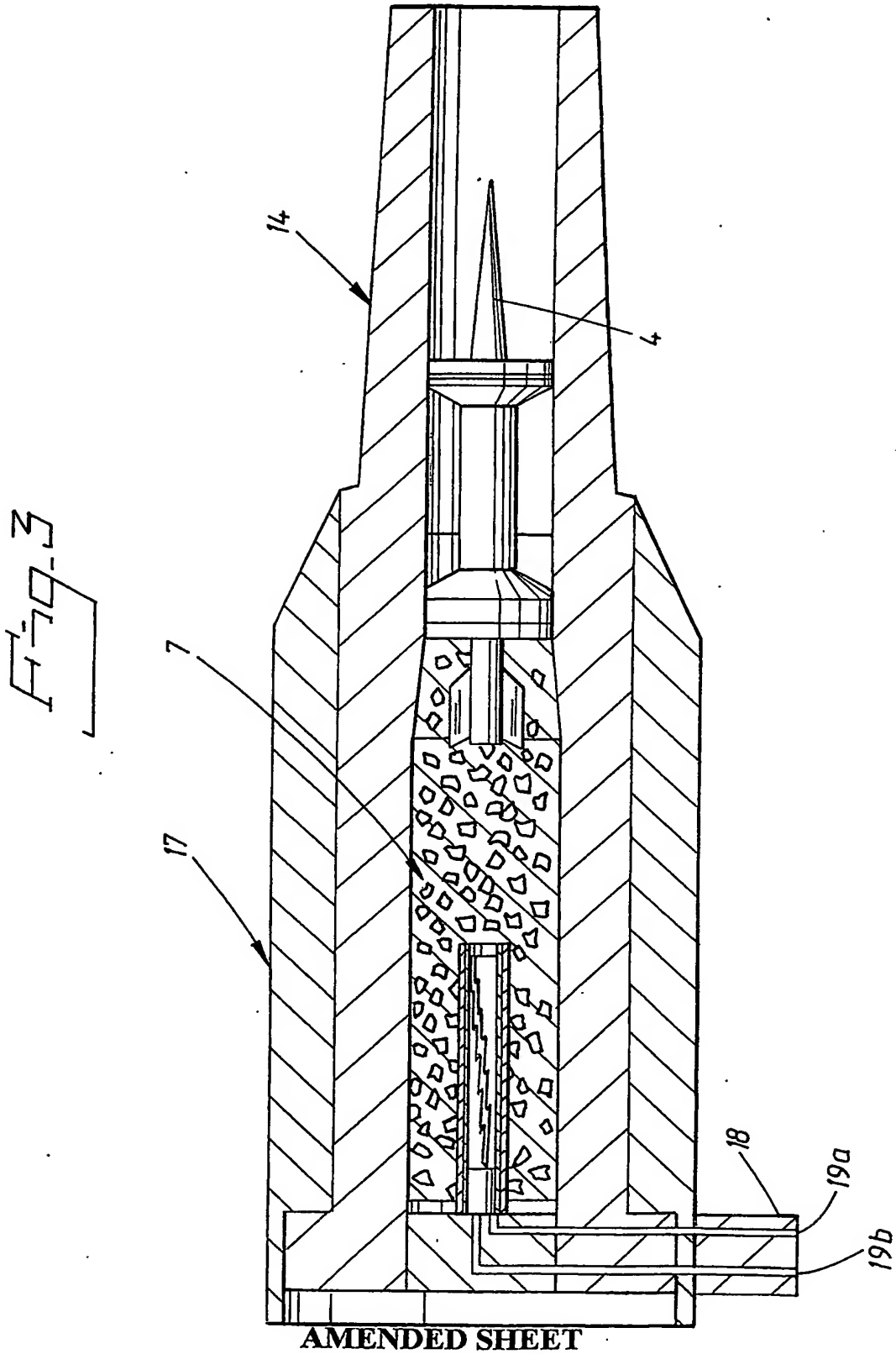


Fig. 2

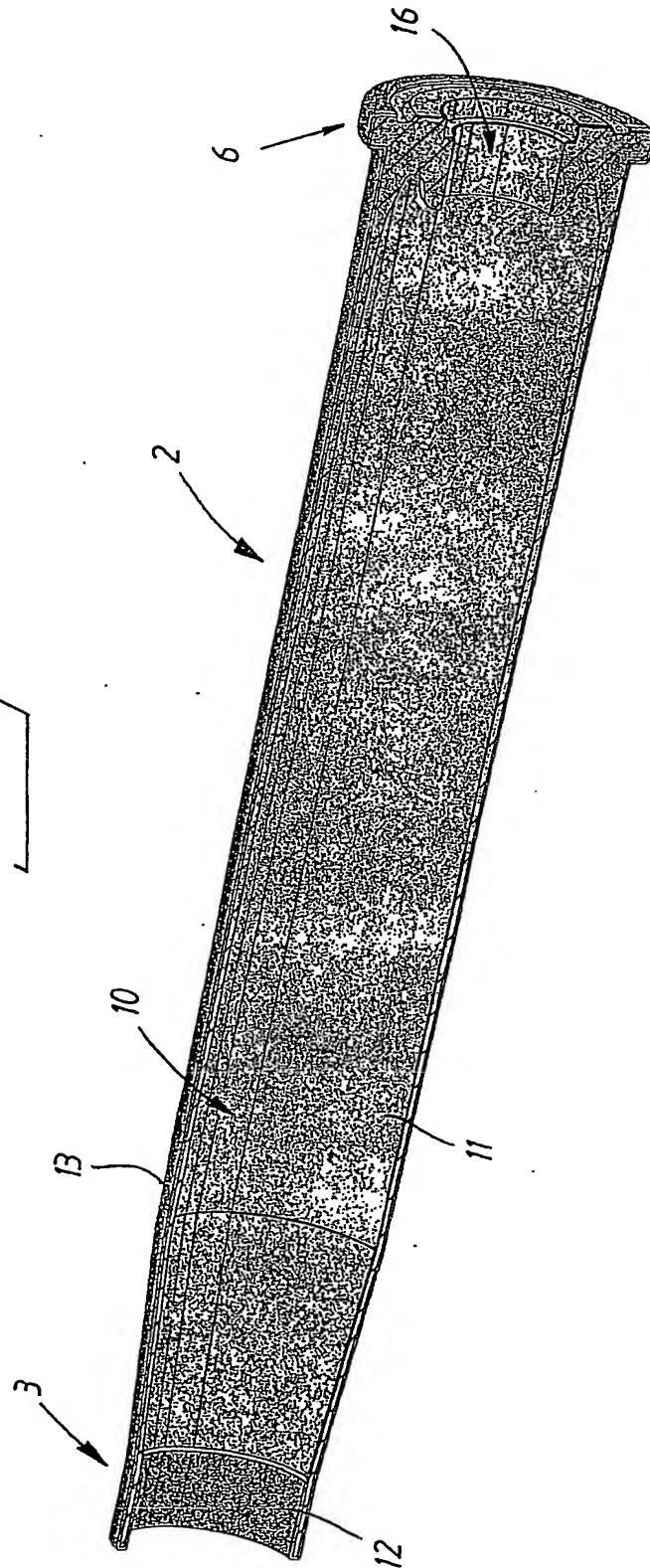


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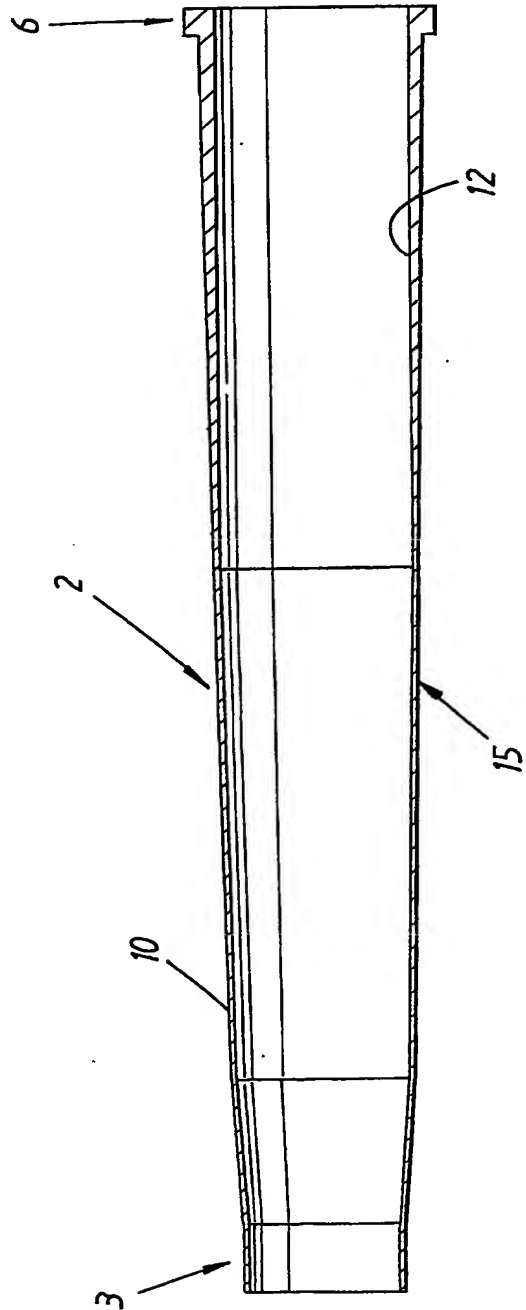
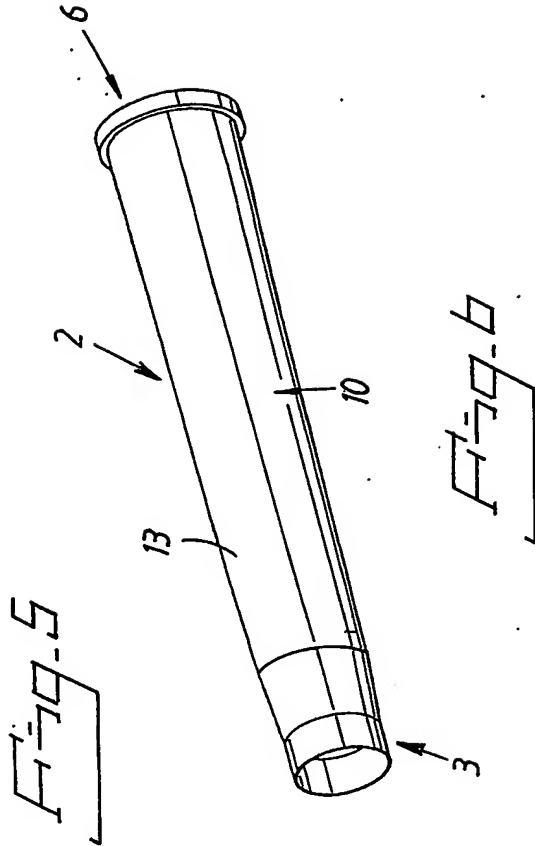


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Fig. 4



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